

IN THE CLAIMS:

The following is a complete listing of claims in this application.

1. (currently amended) A method of extracting in a vacuum (4) electrons emitted from a cathode (2) situated in spaced-apart relationship with an anode (3) which is placed at a given potential relative to the cathode by means of a bias source (5), the method comprising:

· making a cathode (2) presenting at least one junction (9) between a metal (7) serving as a reservoir of electrons and an n-type semiconductor (8), ~~the cathode presenting an electron emission surface (11)~~ junction possessing a surface potential barrier with a height ~~of a few tenths of an electron volt (eV)~~ in a range of 0.05 to 0.5 eV, the n-type semiconductor presenting an emission surface for electrons and ~~presenting having a~~ thickness lying in the a range of 1 nm to 20 nm, defined by the value of the lowering desired for the surface potential barrier;

injecting electrons through the metal/semiconductor junction (9) to create a space charge (10) in the semiconductor (8) sufficient to lower the surface potential barrier of the semiconductor to a value that is less than or equal to 1 eV relative to the Fermi level of the metal (7); and

· using the bias source (5) that creates an electric field in the vacuum to control the height of the surface potential barrier (V_p) of the n-type semiconductor, so as to modify in reversible manner the electron affinity of the n-type semiconductor surface in order to control the emission of an electron flux towards the anode.

2. (currently amended) A method according to claim 1, wherein the bias source (5) is controlled so as to create an electric field suitable for causing the height of the surface

potential barrier (V_p) of the n-type semiconductor to be greater than the level of the states occupied by electrons in the n-type semiconductor so as to obtain an emission surface that does not emit electrons.

3. (currently amended) A method according to claim 1, wherein the bias source (5) is controlled so as to create an electric field suitable for causing the height of the surface potential barrier (V_p) of the n-type semiconductor to be substantially equal to the level of the states occupied by electrons in the n-type semiconductor, in order to obtain an emission surface having low electron affinity.

4. (currently amended) A method according to claim 1, wherein the bias source (5) is controlled so as to create an electric field suitable for causing the height of the surface potential barrier of the n-type semiconductor to be lower than the level of the states occupied by electrons in the n-type semiconductor so as to obtain an emission surface of negative electron affinity.

5. (currently amended) A method according to claim 1, wherein the temperature of the cathode (2) is controlled in order to control the flux of the emitted electron beam.

6. (currently amended) A device for extracting in a vacuum (4) electrons emitted from a cathode (2) situated in a spaced-apart relationship with at least one anode (3) placed at a given potential relative to the cathode by means of a bias source (5) , the device ~~being characterized in that it comprises~~ comprising:

an emission cathode (2) having at least one junction (9) between a metal (7) and an n-type semiconductor (8) , possessing a surface potential barrier with a height ~~of a few tenths of an electron volt~~ in a range of 0.05 to 0.5 eV, the n-type semiconductor presenting an emission surface for

electrons and possessing thickness lying in the range 1 nm to 20 nm defined by the value of the lowering desired for the surface potential barrier; and

- a bias source (5) creating an electric field in the vacuum (4) serving firstly to inject electrons through the metal/semiconductor junction (9) so as to create a space charge (10) in the semiconductor (8) sufficient to lower the surface potential barrier of the semiconductor to a value that is less than or equal to 1 eV relative to the Fermi level of the metal (7), and also to control the height of the surface potential barrier of the n-type semiconductor, i.e. to reversibly modify the electron affinity of the surface of the n-type semiconductor in order to control electron flux emission.

7. (currently amended) A device according to claim 6, ~~characterized in that it includes~~ including an electron extraction electrode followed by an anode for receiving the extracted electrons.

8. (currently amended) An electron emission cathode for a device for extracting an electron beam in a vacuum in accordance with claim 6, the cathode ~~being characterized in that it comprises~~ comprising:

- a first portion forming an electron reservoir and constituted by at least one metal layer (7); and

- a second portion forming a conduction medium for the electrons injected into the metal layer and formed by an n-type semiconductor (8) co-operating with the metal layer to define a metal/semiconductor junction (9) possessing a potential barrier with a height ~~of a few tenths of an electron volt~~ in a range of 0.05 to 0.5 eV, the n-type semiconductor presenting an emission surface (11) for the electrons, and possessing thickness lying in the range 1 nm to 20 nm defined

by the value of the lowering desired for the surface potential barrier.

9. (currently amended) An emission cathode according to claim 8, ~~characterized in that the electron metal/semiconductor~~ junction possesses a potential barrier of height lying in the range 0.05 eV to 0.5 eV, and preferably of approximately 0.1 eV.

10. (currently amended) A cathode according to claim 8, ~~characterized in that wherein~~ the first portion forming an electron reservoir is formed by a metal layer (7) carried on a substrate (13) of metal, semiconductor, or insulation.

11. (currently amended) A cathode according to claim 8, ~~characterized in that wherein~~ the n-type semiconductor (8) possesses an emission surface (11) for electrons that is substantially ~~plane~~ planar.

12. (currently amended) A cathode according to claim 8, ~~characterized in that wherein~~ the n-type semiconductor (8) possesses an emission surface (11) for electrons that presents projections (14, 15) enabling electron emission to be confined in register with each of them.

13. (currently amended) A cathode according to claim 11, ~~characterized in that wherein~~ the n-type semiconductor (8) possesses an emission surface (11) for electrons presenting projections (14) made in determined locations by lithographic techniques.

14. (currently amended) A cathode according to claim 11, ~~characterized in that wherein~~ the n-type semiconductor (8) possesses an emission surface for electrons presenting projections (15) in the form of points, obtained by ion bombardment of the metal layer deposited on an insulating substrate.

15. (currently amended) A cathode according to claim 8,

~~characterized in that~~ wherein the first portion forming an electron reservoir is constituted by a metal layer ~~(7)~~ carried by a semiconductor substrate having active components arranged therein for locally controlling electron emission.

16. (currently amended) A cathode according to claim 10, ~~characterized in that~~ wherein the substrate ~~(13)~~ possesses an individual point shape or an individual pinhead shape for use in an individual electron gun.

Claims 17-18 (canceled).

19. (new) A method according to claim 1, wherein the metal-semiconductor junction possesses a potential barrier of height lying in the range of approximately 0.1 eV.

20. (new) A device according to claim 6, wherein the metal-semiconductor junction possesses a potential barrier of height lying in the range of approximately 0.1 eV.